

Factors Affecting Plastic Waste Management in Enugu Metropolis, Enugu State Nigeria

Onyebueke, Ogechukwu O; Onwuka, Shalom U

Department of Environmental Management, Nnamdi Azikiwe University, Awka, Anambra State, Nigeria

ABSTRACT

Plastic waste ubiquity in the environment poses lots of threats to the ecosystem. The improper management of these wastes has led to the deterioration of the aesthetic beauty of the environment, blocking of drainage systems thereby causing an overflow of water, loss of aquatic life, reduction of soil fertility, pollution of water bodies. Therefore this study was aimed at determining the factors affecting plastic waste management in Enugu Metropolis using a survey design method. Data obtained were analyzed using Principal Component Analysis (PCA). Results showed that governmental, attitudinal, political, and economic factors are the factors that affect plastic waste management in Enugu Metropolis. Attitudinal change by the public towards the use of plastic products and management of its corresponding waste is necessary. This can be achieved through awareness creation on the environmental impact of plastic waste. Enactment of strong policies on plastic waste by the government, with the implementation of strict enforcement/restraining orders, is fundamental.

Keywords: *plastics waste, management, factors*

How to cite this paper: Onyebueke, Ogechukwu O | Onwuka, Shalom U "Factors Affecting Plastic Waste Management in Enugu Metropolis, Enugu State Nigeria" Published in International Journal of Trend in Scientific Research and Development (ijtsrd), ISSN: 2456-6470, Volume-5 | Issue-1, December 2020, pp.418-424, URL: www.ijtsrd.com/papers/ijtsrd35885.pdf



IJTSRD35885

Copyright © 2020 by author(s) and International Journal of Trend in Scientific Research and Development Journal. This is an Open Access article distributed under the terms of the Creative Commons Attribution License (CC BY 4.0) (<http://creativecommons.org/licenses/by/4.0>)



INTRODUCTION

The unique quality of plastics has led to daily use in almost every aspect of human life. The increase in the consumption of plastic products has resulted in the rise in the generation of plastic waste which has constituted a major concern in the environment. Plastic wastes make up a good percentage of municipal solid wastes. Due to plastic ubiquity and the environmental impacts associated with current disposal methods, plastics have recently gathered a global attention (Organization for Economic Co-Operation and Development (OECD), 2018). Most developed and developing countries have put in place and continue to improve their plastic waste disposal, collection, and recycling methods to reduce the impact of plastic waste (Duru, Ikpeama, and Ibekwe, 2019). Moreover, various governments across the world have come up with creative policies to mitigate the plastic threat (Sanika and Rashmi, 2019). In countries like Bangladesh, Ghana, Rwanda, Washington DC, Uganda, South Africa, Tanzania, and Ethiopia, the prevention of plastic waste generation have been achieved through tax/banning of the use of some types of plastics (Jonathan, 2009; Osinbanjo, 2018 and Bashir, 2013).

The Nigerian government, both at the Federal and State level, has established various agencies and authorities to ensure effective waste management and safeguard the environment. In Enugu state, the Enugu State Waste Management Authority (ESWAMA) was established to develop and implement policies on solid and liquid waste management to ensure the health and well being of the

people. ESWAMA has the responsibility to ensure effective collection, removal, treatment, and disposal of all kinds of wastes. It also has the mandate to check the illegal dumping and littering of refuse at roadsides, enclosures, streams in neighborhoods, and drainage. The agency is empowered to prosecute defaulters of sanitation laws, while providing waste management facilities (Titus and Anim, 2014).

Despite the environmental policies coupled with the efforts of the environmental regulatory authorities like ESWAMA, in the protection of the environment, plastic waste generation remains incessantly unbearable to the tolerant carrying capacity of our environment (Titus and Anim, 2014). This could be attributed to different factors which include: poor funding, weak/lack of policy on plastic waste management, poor legislation and implementation of policies, lack of policy enforcement and responsibility, limited infrastructure and professionals to manage plastic waste, the unwillingness of stakeholders to participate in plastic waste management, lack of education and awareness creation on the effects of plastic waste, lack of incentives, low involvement of packaging and product producers, people's attitude/behavior, lack of political will and good governance, poor data information for planning, the ineffectiveness of waste management authorities, uncontrolled consumption of plastic products. These factors have led to the proliferation of plastic waste in Nigerian cities of which Enugu metropolis is not left out.

LITERATURE REVIEW

In a study of plastic waste menace in Kenya, Ong'unya, Aurah, Nabwire and Songok (2014) established that the main factors that contribute to the accumulation of plastic wastes included: lack of adherence to the guidelines on solid waste management by stakeholders in the city, failure of the City Council to address the problem of plastic bag waste due to weak policies.

The result in the work of Aurah (2013), to assess the extent to which plastic bag waste management methods used in Nairobi City promote sustainability, revealed that the problem of plastic bag waste is a consequence of ineffective by-laws on littering and illegal dumping; inadequate garbage collection and throw-away culture by the public. Inadequate collecting and processing infrastructure lead to an increase in plastic litter in the environment (Helen, Sabine, and Margriet, 2016).

Onyenekenwa and Agbazue, (2011) conducted a review study on the policy on the protection of Nigeria's environment. The result showed that many of the policies were not formulated with contributions from informed masses, nor based on nationally generated baseline data. Rather, they are mostly guidelines and standards adopted from the adopted and approved materials of the appropriate system of the United Nations, thereby compromising socio-economic and climatic differences. They also noted that implementation and monitoring are wishy-washy and dindon affairs, crippled by widening and deepening corruption.

In the study on municipal solid waste management problems in Nigeria: evolving knowledge management solution by Beatrice and Jussi (2013), it was revealed that inefficient management of waste by individuals, households, consumers, and waste management companies can be attributed to inadequate information on waste management benefits, lack of producers' involvement in waste management as well as poor implementation of government policies.

Ogwueleka (2009) carried out a study on municipal solid waste characteristics and management in Nigeria. The result showed that the common constraints faced by environmental agencies in waste management include lack of institutional arrangement, insufficient financial resources,

absence of by-laws and standards, inflexible work schedules, insufficient information on quantity and composition of waste, and inappropriate technology.

In exploring the understanding of residents' and enterprises' perceptions, behaviors, and their willingness to pay for resources recycling by Song, Zhao, Lam, Zhu, Yuan, and Wang (2019), the result showed that most of the respondents do not separate their recyclable materials for recycling. The study also noted that recycling facilities and site conditions are very poor, including limited space for recycling and storage, aging facilities, an informal recycling process and a lack of workforce contributes to the problem.

On the attitudinal factors affecting plastic waste management, it was observed that some people are aware of the environmental implications of plastic waste but are not willing to transform their awareness to practice (Gündoğdu, Yesilyurt and Erbaş (2018); David and Richard (2015); Srinivasan, Swarnapriya, Felix and Pravin (2019)). However, in a questionnaire-based study by Bright and Maurice (2016) to identified households' plastic waste management practices and challenges, the result showed that dealing with the problem of plastic waste required a change of attitude towards waste disposal, discontinuation of plastic use, recycling, and all stakeholder participation in waste management.

METHODOLOGY

With the use of survey research design, data were collected from 400 households in Enugu Metropolis comprising three Local Government Areas which are: Enugu North L.G.A, Enugu South L.G.A, and Enugu East L.G.A. Based on the population density of households in each of the three Local Government Areas, 126, 118, 156 questionnaires were distributed to households in Enugu North L.G.A, Enugu South L.G.A, and Enugu East L.G.A respectively. Principal Component Analysis (PCA) was used to analyze the data to identify the major factors affecting plastic waste management. It involved the computation of the correlation between the original data of each variable and the principal component using the correlation procedure. To interpret the principal components, the variables that are most strongly correlated with each component were identified. The naming of each component was dependent on variable loadings and their strong correlation with the respective components.

RESULT AND FINDINGS

A. Principal Component Analysis Result for factors affecting plastic waste management in Enugu North LGA

The total variance explained as shown in Table 1 indicates how many components best explain the overall variation in the original set of measured variables. Three components have been extracted which explains 89.535% of the overall variation in the original set of variables. The first component explained 32.500% of the overall variance, the second component explained 32.156%, while the third component explained 24.879%. The three components were used to summarize the overall variation in the original set of variables.

Table 1: Total Variance Explained in PCA for factors affecting plastic waste management in Enugu North LGA

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	23.653	78.842	78.842	23.653	78.842	78.842	9.750	32.500	32.500
2	2.165	7.218	86.060	2.165	7.218	86.060	9.647	32.156	64.656
3	1.043	3.475	89.535	1.043	3.475	89.535	7.464	24.879	89.535

The rotated component matrix as shown in Table 2 represents the correlation between each of the measured variables and each extracted or retained component. The loading of each variable on each component after rotation reveals the following:

➤ First Principal Component

The first principal component is strongly correlated with seventeen of the original variables. It increases with increasing values for the seventeen variables which vary together. This principal component is a measure of the level of income, limited space for recycling, insufficient financial resources, non-involvement of citizen in policymaking, negligence, non-cooperation with waste management authorities, lack of interest in plastic recycling, lack/inefficient waste transportation equipment, inefficiency in plastic waste collection, lack of interest in plastic reuse, use and throw away culture of the people, lack of interest in government policies, reduced environmental monitoring, little or no encouragement on recycling, lack of adherence to guidelines of waste management, lack of political will, non-implementation of extended producers responsibility. These variables are classified as economic/attitudinal factors. It implies that the economic state of the area and the attitude of the public effect plastic waste management.

➤ Second Principal Component

The second principal component correlates with nineteen of the original variables. It increases with increasing values for these variables. The second principal component correlates strongly with lack of interest in plastic recycling, lack/inefficient waste transportation equipment, lack of interest in plastic reuse, reduced environmental monitoring, the ineffectiveness of waste management authorities, lack of strict enforcement of environmental laws, lack of plastic waste management facilities, lack/inadequate environmental policies and legislation, inappropriate technologies to manage plastic waste, limited professionals to handle plastic waste, little or no encouragement on recycling, lack of adherence to guidelines of waste management, inefficient by laws on littering, lack of political will, non-implementation of extended producers responsibility, poor implementation of government policies, low level of knowledge on environmental matters, low public awareness, lack of concern for the environment. This component is an indication of Political factors.

➤ Third Principal Component

The third principal component correlates positively with fifteen of the original variables and increases with increasing values for these variables. It correlates strongly with negligence, non-cooperation with waste management authorities, inefficiency in plastic waste collection, use and throw away culture of the people, lack of interest in government policies, reduced environmental monitoring, inefficient by-laws on littering, lack of political will, non-implementation of extended producers responsibility, non-segregation of waste at source, poor implementation of government policies, low level of knowledge on environmental matters, corruption, low public awareness, lack of concern for the environment. These variables are classified as attitudinal/governmental factors.

Table 2 Rotated Component Matrix in PCA for factors affecting plastic waste management in Enugu North LGA

	Component		
	1	2	3
Level of income	.875		
Limited space for recycling	.847		
Insufficient financial resources	.812		
Non-involvement of citizen in policymaking	.764		
Negligence	.762		.591
Non-cooperation with waste management authorities	.754		.501
Lack of interest in plastic recycling	.735	.517	
Lack/inefficient waste transportation equipments	.693	.574	
Inefficiency in plastic waste collection	.669		.606
Lack of interest in plastic reuse	.650	.537	
Use and throw away culture of the people	.641		.634
Lack of interest in government policies	.623		.545
Reduced environmental monitoring	.589	.505	.524
Ineffectiveness of waste management authorities		.945	
Lack of strict enforcement on environmental laws		.902	
Lack of plastic waste management facilities		.796	
Lack/inadequate environmental policies and legislation		.767	
Inappropriate technologies to manage plastic waste		.743	
Limited professionals to handle plastic waste		.679	
Little or no encouragement on recycling	.607	.661	
Lack of adherence to guidelines of waste management	.516	.642	
Inefficient by laws on littering		.632	.570
Lack of political will	.521	.619	.521
Non-implementation of extended producers responsibility	.502	.573	.568
Non-segregation of waste at source			.785
Poor implementation of government policies		.554	.692
Low level of knowledge on environmental matters		.569	.681
Corruption			.669
Low public awareness		.558	.667
Lack of concern for the environment		.620	.634

B. Principal Component Analysis for factors affecting plastic waste management in Enugu South LGA

The total variance explained as shown in Table 3 indicates how many components best explain the overall variation in the original set of measured variables. Two components have been extracted which explains 88.886% of the overall variation in the original set of variables. The first component explained 45.089 percent of the overall variance, while the second component explained 43.797 percent. These two components were used to summarize the overall variation in the original set of variables.

Table 3 Total Variance Explained in PCA for factors affecting plastic waste management in Enugu South LGA

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	24.971	83.237	83.237	24.971	83.237	83.237	13.527	45.089	45.089
2	1.695	5.649	88.886	1.695	5.649	88.886	13.139	43.797	88.886

The rotated component matrix (Table 4), representing the correlation between each of the measured variables and each extracted or retained component, shows the loading of variables on each component.

➤ First Principal Component

The first principal component is strongly correlated with twenty-three of the original variables. It increases with increasing values for these variables. This component is a measure of the level of income, inefficient by-laws on littering, lack of interest in plastic recycling, low public awareness, non-involvement of citizen in policymaking, lack of adherence to guidelines of waste management, lack of plastic waste management facilities, ineffectiveness of waste management authorities, lack of interest in plastic reuse, corruption, non-cooperation with waste management authorities, lack of interest in government policies, non-implementation of extended producers responsibility, insufficient financial resources, limited professionals to handle plastic waste, reduced environmental monitoring, non-segregation of waste at source, poor implementation of government policies, lack/inefficient waste transportation equipment, negligence, inappropriate technologies to manage plastic waste, low level of knowledge on environmental matters, lack of political will. These variables are classified as governmental/attitudinal factors.

➤ Second Principal Component

The second principal component correlates strongly with twenty-five of the original variables. This component correlates strongly with Lack of adherence to guidelines of waste management, lack of plastic waste management facilities, ineffectiveness of waste management authorities, lack of interest in plastic reuse, corruption, non cooperation with waste management authorities, lack of interest in government policies, non implementation of extended producers responsibility, insufficient financial resources, limited professionals to handle plastic waste, reduced environmental monitoring, non segregation of waste at source, little or no encouragement on recycling, lack of strict enforcement on environmental laws, limited space for recycling, inefficiency in plastic waste collection, lack/inadequate environmental policies and legislation, lack of concern for the environment, use and throw away culture of the people, poor implementation of government policies, lack/inefficient waste transportation equipments, negligence, inappropriate technologies to manage plastic waste, low level of knowledge on environmental matter, lack of political will. With respect to the variable loadings, this component is an indication of political factors.

Table 4: Rotated Component Matrix in PCA for factors affecting plastic waste management in Enugu South LGA

	Component	
	1	2
Level of income	.938	
Inefficient by laws on littering	.883	
Lack of interest in plastic recycling	.830	
Low public awareness	.826	
Non-involvement of citizen in policymaking	.824	
Lack of adherence to guidelines of waste management	.784	.519
Lack of plastic waste management facilities	.781	.535
Ineffectiveness of waste management authorities	.774	.561
Lack of interest in plastic reuse	.773	.586
Corruption	.766	.549
Non-cooperation with waste management authorities	.755	.581
Lack of interest in government policies	.750	.575
Non-implementation of extended producers responsibility	.747	.600
Insufficient financial resources	.713	.609
Limited professionals to handle plastic waste	.712	.614
Reduced environmental monitoring	.705	.579
Non segregation of waste at source	.692	.567
Little or no encouragement on recycling		.886
Lack of strict enforcement on environmental laws		.877
Limited space for recycling		.865

Inefficiency in plastic waste collection		.853
Lack of/inadequate environmental policies and legislation		.849
Lack of concern for the environment		.846
Use and throw away culture of the people		.820
Poor implementation of government policies	.544	.794
Lack/inefficient waste transportation equipments	.539	.782
Negligence	.533	.778
Inappropriate technologies to manage plastic waste	.597	.723
Low level of knowledge on environmental matters	.585	.715
Lack of political will	.667	.677

C. Principal Component Analysis for factors affecting plastic waste management in Enugu East LGA

From Table 5, two components have been extracted which explains 89.242% of the overall variation in the original set of variables. The first component explained 46.539 percent of the overall variance, while the second component explained 42.703 percent. These two components were used to summarize the overall variation in the original set of variables.

Table 5 Total Variance Explained in PCA for factors affecting plastic waste management in Enugu East LGA

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	25.745	85.816	85.816	25.745	85.816	85.816	13.962	46.539	46.539
2	1.028	3.426	89.242	1.028	3.426	89.242	12.811	42.703	89.242

The rotated correlation between each of the measured variables and each extracted or retained component is shown in the rotated component matrix in Table 6. It shows the loading of each variable on each component after rotation.

➤ First Principal Component

The first principal component is strongly correlated with twenty-seven of the original variables. It increases with increasing values for these variables. This component correlates strongly with limited professionals to handle plastic waste, lack of plastic waste management facilities, lack of interest in government policies, non segregation of waste at source, insufficient financial resources, lack of strict enforcement on environmental laws, non cooperation with waste management authorities, inappropriate technologies to manage plastic waste, poor implementation of government policies, inefficiency by laws on littering, use and throw away culture of the people, low public awareness, corruption, lack/inefficient waste transportation equipments, negligence, level of income, reduced environmental monitoring, lack of interest in plastic reuse, non implementation of extended producers responsibility, low level of knowledge on environmental matters, lack/inadequate environmental policies and legislation, inefficiency in plastic waste collection, little or no encouragement on recycling, ineffectiveness of waste management authorities, lack of political will, limited space for recycling, non involvement of citizen in policymaking. These variables are classified as governmental/economic factors.

➤ Second Principal Component

The second principal component correlates strongly with twenty-four of the original variables and increases with increasing values for these variables. The second principal component correlates strongly with lack of strict enforcement of environmental laws, non-cooperation with waste management authorities, inappropriate technologies to manage plastic waste, poor implementation of government policies, use and throw away culture of the people, low public awareness, corruption, lack/inefficient waste transportation equipment, negligence, level of income, lack of adherence to guidelines of waste management, lack of concern for the environment, lack of interest in plastic recycling, reduced environmental monitoring, lack of interest in plastic reuse, non-implementation of extended producers responsibility, low level of knowledge on environmental matters, lack/inadequate environmental policies and legislation, inefficiency in plastic waste collection, little or no encouragement on recycling, the ineffectiveness of waste management authorities, lack of political will, limited space for recycling, non-involvement of citizen in policymaking. These variables are classified as political/attitudinal factors.

Table 6: Rotated Component Matrix in PCA for factors affecting plastic waste management in Enugu East LGA

	Component	
	1	2
Limited professionals to handle plastic waste	.851	
Lack of plastic waste management facilities	.827	
Lack of interest in government policies	.817	
Non-segregation of waste at source	.808	
Insufficient financial resources	.805	
Lack of strict enforcement on environmental laws	.795	.552
Non-cooperation with waste management authorities	.782	.551
Inappropriate technologies to manage plastic waste	.774	.559
Poor implementation of government policies	.761	.590

Inefficient by laws on littering	.760	
Use and throw away culture of the people	.751	.583
Low public awareness	.746	.502
Corruption	.717	.642
Lack/inefficient waste transportation equipments	.713	.558
Negligence	.684	.661
Level of income	.682	.655
Lack of adherence to guidelines of waste management		.864
Lack of concern for the environment		.851
Lack of interest in plastic recycling		.850
Reduced environmental monitoring	.503	.814
Lack of interest in plastic reuse	.531	.795
Non-implementation of extended producers responsibility	.547	.785
Low level of knowledge on environmental matters	.553	.759
Lack/inadequate environmental policies and legislation	.582	.746
Inefficiency in plastic waste collection	.609	.745
Little or no encouragement on recycling	.631	.707
Ineffectiveness of waste management authorities	.670	.694
Lack of political will	.663	.681
Limited space for recycling	.661	.674
Non involvement of citizen in policy making	.669	.673

DISCUSSION

The study revealed that in Enugu North and Enugu East L.G.A, governmental, attitudinal, political, and economic factors are all contributory factors to plastic waste management in the area. While in Enugu South L.G.A, governmental, attitudinal, and political factors are all contributory factors to plastic waste generation in the areas. Lack of adherence to guidelines of waste management by the citizens, low level of knowledge on environmental matters, people's lack of concern for the environment, use and throw away culture of the people, lack of interest in government policies, non-cooperation with waste management authorities, non-segregation of waste at source are all part of attitudinal factors that have affected the management of plastic waste in Enugu Metropolis. This is coupled with the governmental/political factors which include lack of plastic waste management facilities, inefficient by-laws on littering, low public awareness, lack of strict enforcement of environmental laws, lack of political will, inappropriate technologies to manage plastic waste, corruption, reduced environmental monitoring, lack/inadequate environmental policies and legislation among others. The economic factors which are the level of income and insufficient financial resources are also seen to have effect on plastic waste management in the areas.

CONCLUSION

This study identified the factors that have that affect plastic waste management in the Enugu metropolis. These include governmental, attitudinal, political, and economic factors. Considering these results, attitudinal change by the citizens towards the use of plastic products and management of its corresponding waste is necessary. This can be achieved through awareness creation on the environmental impact of plastic waste. For effective plastic waste management, strong policies on plastic waste should be formulated, with proper implementation and enforcement

References

- [1] C. M. Aurah, "Assessment of Extent to Which Plastic Bag Waste Management Methods Used in Nairobi City Promote Sustainability", American Journal of Environmental Protection, 1(4), pp. 96-101, 2013
- [2] N. H. H. Bashir, "Plastic Problem in Africa. Japanese Journal of Veterinary", Research, 61 (Supplementary): SI -SII, 2013. Doi: 10.14943/Jjvr.61.Supp.SI.
- [3] A. Beatrice, and K. Jussi, "Municipal Solid Waste Management Problems in Nigeria: Evolving Knowledge Management Solution", Environmental and Ecological Engineering, 7(6), pp. 303-308, 2013.
- [4] B. Y. Bright, and M. B. Maurice, "Household Plastic Waste Management in Bolgatanga Municipality: The Issues of Urban Ghana", Lambert Academic Publishing, 2016. <https://www.academia.edu/29363830/household-plastic-waste-management-in-the-Bolgatanga-Municipality.pdf> (accessed 07 July 2020).
- [5] W. E. David, and G.S. Richard, "Attitudes towards Plastic Waste Management in the Ga East Municipality of Ghana", International Journal of Development and Sustainability 4(4), pp. 446-460, 2015.
- [6] R. U. Duru, E. E. Ikpeama, and J. A. Ibekwe, "Challenges and prospects of plastic waste management in Nigeria", Waste Dispos. Sustain. Energy 1, pp. 117-126, 2019. <https://doi.org/10.1007/s42768-019-00010-2>.
- [7] S. Gündoğdu, I. Yesilyurt, and C. Erbaş, "Survey on Awareness and Attitudes of Citizens Regarding Plastic Pollution in Hatay/Samandağ Turkey", Oral Presentation. International Marine & Freshwater Sciences Symposium Marfresh 138 2018 Kemer - Antalya / Turkey, 2018.
- [8] L. Helen, R. Sabine, and S. Margriet, "Plastic, gender and the environment. Findings of a literature study on the lifecycle of plastics and its impacts on women and men, from production to litter", 2017. <https://doi.org/10.13140/RG.2.2.33644.26242>.
- [9] W. Jonathan, "China Plastic Bag Has Saved 1.6m Tones of Oil", The Guardian 22 May 2009.

- <https://www.theguardian.com/environment/2009/may/22/china-plastic-bags-ban-success> (accessed 07 July 2020).
- [10] T. C. Ogwueleka, "Municipal Solid Waste Characteristics and Management in Nigeria", Iran. J. Environ. Health. Sci. Eng., 6(3), pp. 173-180, 2009.
- [11] R. O. Ong'unya, C. M. Aurah, J. L. Nabwire, and J. R. Songok, (2014), "The Plastic Waste Menace in Kenya: A Nairobi City Situation", International Journal of Current Research 6(4), pp. 6175-6179, 2014.
- [12] C. E. Onyenekenwa, and V. C. Agbazue, "Protection of Nigeria's Environment: A Critical Policy Review", Journal of Environmental Science and Technology, 4, pp. 490-497, 2011. doi: 10.3923/jest.2011.490.497.
- [13] Organization for Economic Co-Operation and Development (OECD), "Improving Plastic Management: Trends, Policy Responses and the Role of International Co-Operation and Trade", OECD Environmental Policy Paper No. 12, OECD Publishing, Paris, 2018. <https://www.oecd.org/environment/waste/policy-highlights-improving-plastics-management.pdf> (accessed 6 July 2020)
- [14] O. Osibanjo, "Interview with New Agency of Nigeria (NAN)", 2018.
- [15] S. Sanika, and S. Rashmi, "Plastic waste management: What can India learn from other countries?" 2019. <https://www.downtoearth.org.in/blog/waste/plastic-waste-management-what-can-india-learn-from-other-countries-67048> (accessed 07 July 2020).
- [16] Q. Song, S. Zhao, I. Lam, L. Zhu, W. Yuan, and C. Wang, "Understanding Residents and Enterprises' Perceptions, Behaviors, and their Willing to Pay for Resources Recycling in Macau", Waste Manag. 15(95), pp. 129-138, 2019. doi: 10.1016/j.wasman.2019.06.009.
- [17] N. Srinivasan, V. Swarnapriya, A.J.W. Felix, and T. Pravin, "Assessment of Knowledge and Practice on Plastics among the Professional Course Students of Annamalai University, Tamil Nadu", International Journal Of Community Medicine and Public Health 6(2), pp. 510-514, 2019 doi: <http://dx.doi.org/10.18203/2394-6040.ijcmph20190099>.
- [18] E. A. Titus, and O.A. Anim, "Appraisal of Solid Waste Management Practices in Enugu City, Nigeria", Journal of Environment and Earth Science, 4(1), pp. 97-105, 2014.

